GLAST Large Area Telescope
Calorimeter Subsystem
12.0 EGSE

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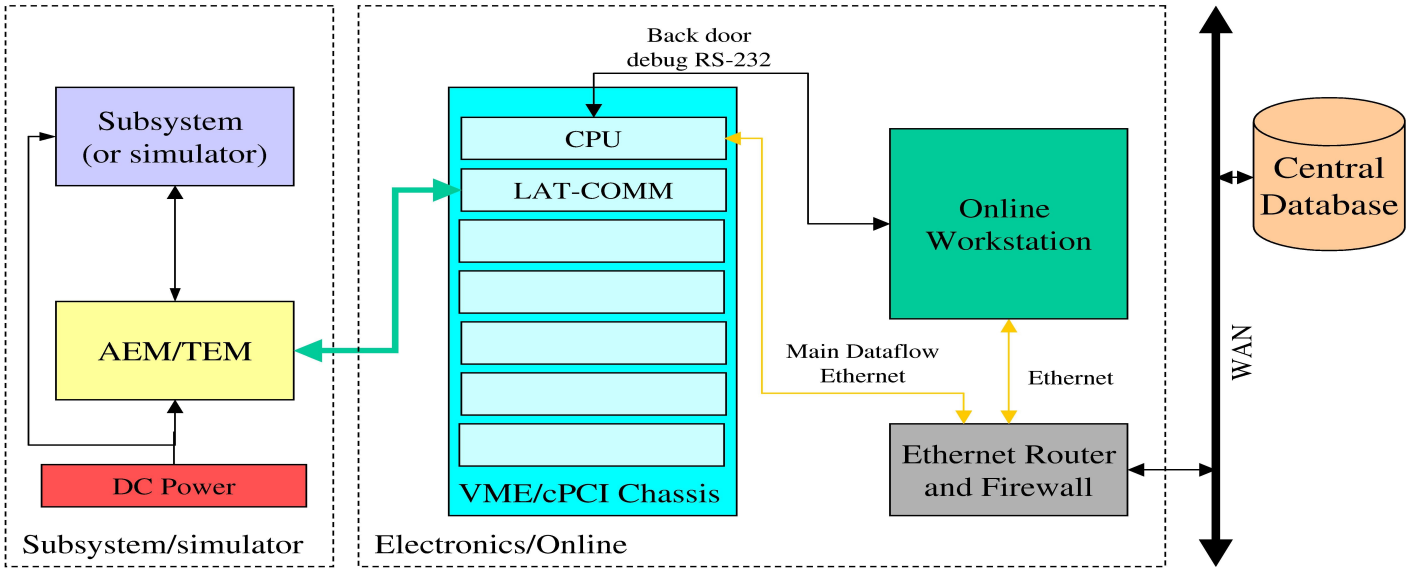
EGSE

- **TestStand II-a (LAT-TD-500.1,LAT-TD-861.1, LAT-TD-862-02)**
  - **Provided by SLAC**
  - **Represents a single-node version of the LAT**
  - **Provides environmental testing capabilities: +-10% voltage adjustment, external clock interface, external triggering**
- **Command & Telemetry (C&T) Package**
  - **Provided by SLAC I&T Online**
  - **Custom package written mostly in Python**
- **Test Executive**
  - **Provided by SLAC I&T**
  - **Layered on C&T Package**
  - **Custom package written mostly in Python**

EM1 EGSE Configuration



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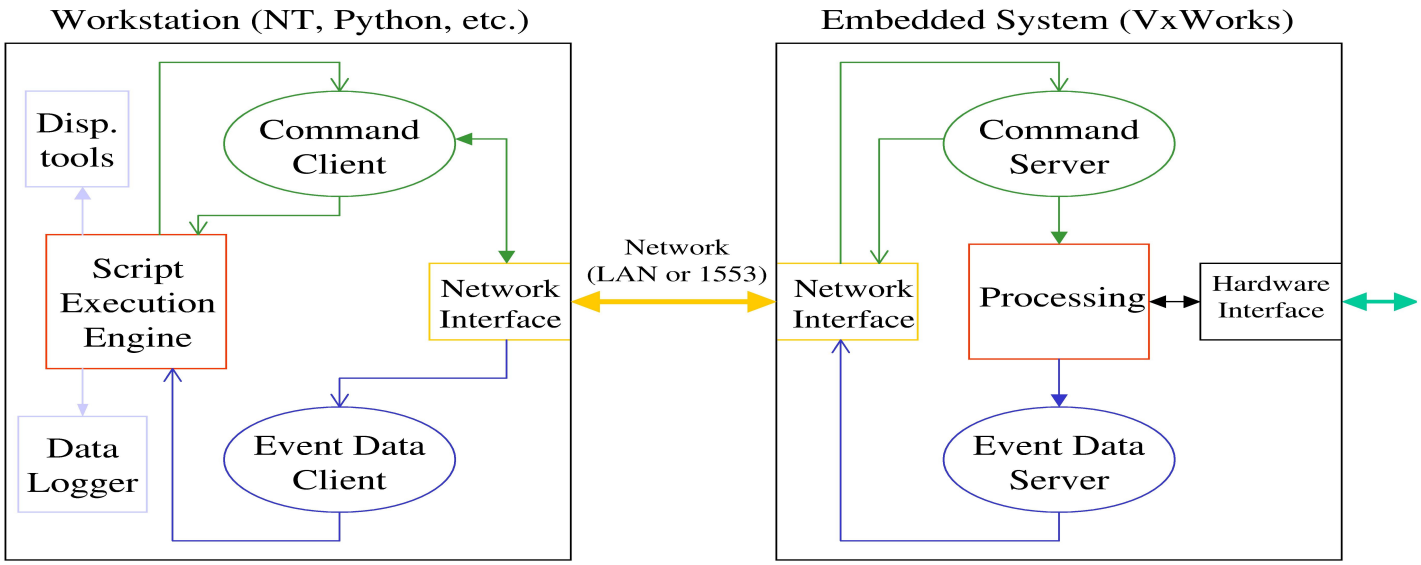
Software block diagram



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Calorimeter Test Procedures

- Derived from Level III/IV requirements
- Test Design Process and Documentation are modeled after ICM Flight Software Project and MIL_STD 498
- Requirements organized into three groups: Functional, Calibration and Performance. Groups further organized into tests
  - Functional Tests include: Trigger, Gain, Charge Injection, Range, I/O, Shaper
  - Calibration Tests include: Light Asymmetry, Light Attenuation, Light Yield, Gain, Non-Linearity, Noisy and Dead Channels, Energy Discriminator, Zero Suppression, Deadtime
  - Performance Tests include: Event rate, Event Fidelity, Command rate
- Test Design – includes statement of requirements, assumptions and constraints, acceptance criteria, test case descriptions, output result description(s)

Calorimeter Test Procedures (Cont)

- Test procedure scripts are written in Python and conform to informal “Run Control” Test Executive interface. Some incompatibility may exist initially due to modifications and additions to address capabilities needed by the Calorimeter that are not yet implemented in I&T environment.
- Tests validated at the design and code phase via walkthrus as appropriate. Well-documented design and code identify how and where requirements are tested.
- Session/Test Output Streams include: Report, Event Data, Housekeeping data, Session log, command log, plots/graphs, trend data
- CAL EGSE Test Software Description Document – LAT-DS-01502

Requirements to Test Traceability Matrix

Requirement #	Summary	Verification Method	Test Name
Level III - 5.2.2	Single CsI Crystal Energy Measurement Range: 5 MeV – 100 GeV	A	Carbon Energy Resolution
Level III - 5.7	Measurement Dead Time: <100 msec	T	DeadTime
Level III - 5.8	Overload Recovery: <500 msec	T	Trigger
Level III - 5.9	Low Energy Trigger Signal: CAL to provide low-energy trigger signal to the LAT trigger system	I	Trigger
Level IV - 5.3.2.2	The energy resolution (1 sigma) shall be <4% (TBR) for sea-level muons within 6 cm of the central point of the crystal. This measurement shall be deduced from the width of the distribution of the difference in signals of the two large diodes, as given in the following expression: sigma(mu) = sigma(Diff) / sqrt(2), where sigma(mu) is the deduced energy resolution for muons as measured in a single large diode and sigma(Diff) is the measured rms of the distribution of differences P-M in the signal from the large diodes of the Plus (P) and Minus (M) faces. This test may be performed with laboratory electronics of arbitrarily low noise performance.	T, A	Light Yield
Level IV - 5.3.3.2	Serial data from the readout electronics shall be merged into a serial message by a tower electronics module (TEM) mounted on the base plate of each module for transfer to the T&DF subsystem.	T	I/O, Trigger
Level IV - 5.3.3.3	The TEM shall process trigger requests and collect rate and housekeeping monitoring from the CAL AFEE and distribute commands from the T&DF to the AFEE.	T	I/O, Trigger
Level IV - 6.2.1	The light yield measured by the large PIN photodiode shall be 5000 e-/MeV for energy depositions at the center of the CsI crystal (beginning of life, room temperature (20-25 deg C), measurement techniques as specified in LAT-TD-00381-01).	T	Light Yield
Level IV - 6.2.2	The light yield measured by the small PIN photodiode shall be 800 e-/MeV for energy depositions at the center of the CsI crystal (beginning of life, room temperature (20-25 deg C), measurement techniques as specified in LAT-TD-00381-01).	T	Light Yield
Level IV - 6.2.3	Copy words from CDE Spec - LA with PIN photodiodes	T	Light Asymmetry,Light Attenuation
Level IV - 9.1	The GCFE shall perform spectroscopic measurements over a range from 0.4 MeV to 100 GeV. Each GCFE ASIC shall service one crystal end. The dynamic range shall be divided into two independent signal chains, one for the low energy range, one for the high energy range.	T	Charge Injection
Level IV - 9.1.1.1	The low energy charge amplifier shall process energy depositions in the 2 MeV to 1.6 GeV range. The characteristics of the inputs to the low energy range are summarized in Table 9.3.	T	Charge Injection
Level IV - 9.1.1.2	The low energy range amplifier shall receive a charge of ~5000 e-/MeV with time constants defined by CsI(T1) scintillation constants. These are identified in Table 9.4.	T	Light Yield
Level IV - 9.1.1.3	The low energy charge amplifier shall meet performance specs when attached to PIN photodiode with capacitance ≤ 90 pF (TBR).	T	Charge Injection

Issues / Concerns

- **Test Executive Interface**
  - **Not Completely formalized**
  - **Implementing workarounds at NRL for capabilities needed by Calorimeter testing but missing from I&T interface**
  - **May require some rework to bring CAL scripts into conformance with I&T interface as capabilities are added**

Summary

- **No show stoppers. Proceeding with EM testing…**